

REMARKS

Favorable reconsideration is respectfully requested in view of the foregoing amendments and the following remarks.

I. EXAMINER TELEPHONE DISCUSSIONS, CLAIM STATUS & AMENDMENTS

Applicants thank Examiner Manoharan for the telephone discussions on September 25, 2006 and thereafter, during which the Examiner proposed amendments to place the application in condition for allowance. Applicants informed the Examiner that they agreed with the Examiner's proposals. Accordingly, Applicants had expected to receive a Notice of Allowance. However, the Examiner has since issued the instant Office Action, which contains a new 103(a) rejection, newly citing Leacock (US 4,147,721).

Claims 17-26 are pending in this application and stand rejected.

Claim 17, 18, 20, 23, and 26 have been amended to specify the structure of the periphery of the collection column and each process regarding the collection of acrylic acid from the reaction gas, based on the disclosure, working examples and Figure 1. See for instance, the support at page 3, lines 1-8, page 6, line 24 to page 7, line 20, page 8, line 16 to page 10, line 26, page 13, line 4 to page 14, line 1.

No new matter has been added.

II. INDEFINITENESS REJECTION

On page 2 of the Office Action, claims 17-26 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for the reasons set forth.

It is respectfully submitted that the present amendment overcomes this rejection.

In reply to items (a) and (b) on page 2 of the Action, please note the structure of the periphery of the collection column and each process regarding the collection of acrylic acid from the reaction gas are clarified by the amendments to claim 17. Accordingly, the amended claims more clearly define the collection column and each process step involved in the method of the present invention. It is respectfully submitted that the skilled artisan would understand the metes

and bounds of the claim terminology due to this amendment and the in view of the knowledge in the art. In further reply to the Office's concern in item (a) as to what is intended by "the reaction gas is collected in the aqueous medium" in claim 17, please note that acrylic acid in the reaction gas is absorbed into an aqueous medium by direct contact of the reaction gas rising in the column and the aqueous medium introduced into the column from the top part (but under the top) of the column.

Thus, the rejection of claims 17-26 under 35 U.S.C. § 112, second paragraph, is untenable and should be withdrawn.

III. OBVIOUSNESS REJECTION

On pages 3-4 of the Office Action, claims 17-26 were newly rejected under 35 U.S.C. § 103 as obvious over EP 0778255 in view of Leacock (US 4,147,721). Leacock was newly cited.

This rejection is respectfully traversed as applied to the amended claims.

To establish obviousness, three criteria must be met. First, the prior art references must teach or suggest each and every element of the claimed invention. M.P.E.P. § 2143.03. Second, there must be some suggestion or motivation in the references to either modify or combine the reference teachings to arrive at the claimed invention. M.P.E.P. § 2143.01. Third, the prior art must provide a reasonable expectation of success. M.P.E.P. § 2143.02.

The arguments set forth in the response filed July 14, 2006 traversing the 103(a) rejection over EP 0778225 are reiterated herein. In this regard, the deficiencies of EP 0778225 are reiterated herein. Specifically, in the last response, Applicants argued that EP 0778225 fails to render the invention obvious on the basis the reference neither discloses or suggests any of the following features of the claimed invention: (1) a collection column with a heat-removing device attached thereto; and (2) controlling the amount of heat removed in the collection column so that B/A meets the condition $0.8 < B/A < 1.25$. Accordingly, EP 0778225 fails to disclose or suggest each and every element of the claimed invention.

In reply, the Office issued the instant 103(a) obviousness rejection, newly citing Leacock (US 4,147,721), as allegedly disclosing the concept of performing heat removal in a distillation column by using a heat-removing device in the column. See page 3 of the Action.

However, it is respectfully submitted that the present invention is unobvious over the combination of EP 0778255 and Leacock, because both references fail to disclose or suggest a means of running the collection under a constant and good condition by conducting heat removal so as to satisfy that B/A meets the condition $0.8 < B/A < 1.25$ as in the present invention. Nor do the references disclose or suggest the third line and the heat removing device of the collection column of the present invention. Furthermore, the cited references lack a reasonable expectation of success of combining and modifying their teachings to arrive at the claimed invention.

The collection column of the present invention substantially comprises two basic units.

One unit is a portion from the column bottom part of the collection column ("column bottom part") to a position where the liquid in the bottom part of the column ("column bottom liquid" or "circulated liquid") is returned to the column after the liquid has been cooled by the external heat exchanger. In this portion, by sprinkling the liquid to the reaction gas introduced into the column, the reaction gas is cooled directly and condensed. The portion is equal to the quench tower of Leacock (US 4,147,721), and the reaction gas is condensed partially in this portion.

The second unit of the present invention is a portion from the position where the column bottom liquid is returned to the column to the top of the column. Acrylic acid in the reaction gas is absorbed into an aqueous medium by the direct contact of the reaction gas rising in the column and the aqueous medium introduced into the column from the top part (but under the top) of the column. This portion is equal to an absorption tower which collects remaining acrylic acid in the reaction gas, not condensed at the portion equivalent to the quench tower.

In the present invention, the recovery of acrylic acid is enhanced because of the effect of the portion equivalent to the quench tower, as compared to a general quench tower.

The invention disclosed by Leacock is the recovery of methacrylic acid in a process of producing methacrylic acid. The boiling point of methacrylic acid is higher by 20°C than that of

acrylic acid. Therefore, in Leacock, a satisfactory recovery can be obtained even without the portion equivalent to the absorption tower.

Accordingly, it is respectfully submitted that Leacock lacks a motivation to combine and/or modify the teachings therein with EP 0778255 to arrive at the present invention having a means of running the collection under a constant and good condition by conducting heat removal so as to satisfy that B/A meets the condition $0.8 < B/A < 1.25$ as in the present invention.

On the other hand, in the case where the recovery of acrylic acid is the target as in the present invention, it is difficult to sufficiently collect acrylic acid by using only a quench tower like that disclosed in Leacock. Consequently, the combination of Leacock and EP 0778225 lack a reasonable expectation of success of combining and modifying their teachings to arrive at the claimed invention. In contrast, it is effective to use the collection column having functions of both the quench tower and absorption tower as in the present invention.

One object of the present invention is to maintain a running condition of the collection column having functions of both the quench tower and absorption tower to a good and constant condition. Therefore, the Applicants found that it is effective to control the amount of heat removed (removed heat amount) so as to satisfy " $0.8 < (B/A) < 1.25$."

At column 5, lines 17 to 66 of Leacock relied upon by the Office, more specifically at column 5, lines 57 to 61, Leacock discloses that "the temperature of the recirculation stream entering the quench tower 26 may be selected to optimize the recovery of methacrylic acid, while minimizing the size and operating costs of the equipment involved."

However, this disclosure only indicates a general guideline to design a heat exchanger, that is, the temperature of external recirculation liquid should be determined so that the liquid can be cooled effectively and economically. Further, the disclosure does not provide any information how much heat-removing is necessary.

Actually, in the quench tower disclosed in Leacock, the running of the quench tower can be maintained to a constant condition by maintaining the removed heat amount in constant. When the amount of the reaction gas introduced into the quench tower is increased or decreased,

the running condition can be maintained in constant by increasing or decreasing the removed heat amount correspondingly.

On the other hand, in the collection column of the present invention, since the portion equivalent to the absorption tower further influences the running condition of the column, the required heat removed amount is increased or decreased by fluctuations in running the portion. When the amount of the reaction gas introduced into the collection column is increased or decreased, the removed heat amount is not in proportion to the increase or decrease in the amount of the reaction gas, unless (however, it is actually impossible) the amount of the aqueous medium introduced from the top part of the column perfectly follows the increase or decrease of the amount of the reaction gas. In such a collection column, the inventors found that it is effective for operating under a constant and good condition by conducting heat-removal so as to satisfy " $0.8 < (B/A) < 1.25$."

As mentioned above, one problem to be solved by the present invention is to maintain the running condition, of the collection column having functions of both the quench tower and absorption tower. The Applicants solved this problem by operating/running the collection column under a constant and good condition by conducting heat-removal so as to satisfy " $0.8 < (B/A) < 1.25$ ". It is again respectfully submitted that the means for solving this problem is not disclosed or suggested by Leacock or EP'778,225, which discloses none of the third line and the heat removing device of the collection column of the present invention.

Thus, the present invention is unobvious over the combination of EP 0778255 and Leacock, because both references fail to disclose or suggest a means of running the collection under a constant and good condition by conducting heat removal so as to satisfy that B/A meets the condition $0.8 < B/A < 1.25$ as in the present invention. Furthermore, the references fail to disclose or suggest the third line and the heat removing device of the collection column of the present invention. Lastly, the cited references lack a reasonable expectation of success of combining and modifying their teachings to arrive at the claimed invention.

Thus, the rejection of claims 17-26 under 35 U.S.C. 103(a) is untenable and should be withdrawn.


CONCLUSION

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is in condition for allowance and early notice to that effect is hereby requested.

If the Examiner has any comments or proposals for expediting prosecution, please contact the undersigned attorney at the telephone number below.

Respectfully submitted,

Shuhei YADA et al.

By: 
Jay F. Williams
Registration No. 48,036
Attorney for Applicants

JFW/mjw
Washington, D.C. 20006-1021
Telephone (202) 721-8200
Facsimile (202) 721-8250
February 27, 2007